Secondary Water System Master Plan

Prepared For:

City of South Jordan

Prepared By:

October 2004

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CHAPTER 1
INTRODUCTION

1.1 Background

Presently a large amount of the City of South Jordan's (City) summer water usage is consumed while watering outdoor landscaping. The City's single source of culinary water is purchased from Jordan Valley Water Conservancy District (JVWCD). The City currently purchases water for an average price of $330 per acre-foot and based on recent increases, anticipates that the price could increase by 50 percent over the next 10 years. For this reason the City is very interested in developing alternative outdoor watering sources which would decrease their reliance on JVWCD water. Also the City realizes that drinking water supplies are a resource that should be preserved by utilizing alternative water sources for outdoor irrigating.

The City has accumulated a substantial amount of water shares in various canal companies that cross through the City. The City believes these water shares can be utilized to offset the outdoor use of JVWCD water and therefore provide the citizens with a long term economical solution to their outdoor watering needs.

Roughly one-third of the City's residents have access to secondary water piping through many independent systems scattered throughout the City. However, many of these systems are not presently connected to a water source and are not operable. Only a small number of these secondary systems are operating satisfactorily with the majority of the systems having significant problems.

In an effort to reduce and conserve outdoor culinary water usage, the City formed a Citizens Secondary Water Study Committee (Citizens Committee). The Citizens Committee's mission has been to develop recommendations for a secondary water system within South Jordan City. The committee requested a feasibility study of a number of alternatives. For that reason the City retained Franson Noble Engineering to prepare a feasibility report to objectively evaluate alternatives and provide cost estimates. The results of that feasibility study were presented in a report entitled *Secondary Water System Feasibility Study* dated January 2003.

The Citizens Committee has recommended Alternative B from the January 2003 Secondary Water System Feasibility Study as the proposed secondary system plan. This plan is a city-wide pressurized secondary system excluding the Daybreak Development. The Daybreak Development is responsible for studying, designing and developing its own culinary and secondary water systems.

The feasibility of a secondary system for South Jordan City was also studied in 1999. That study is documented in the report titled: *Secondary Water System Master Plan* prepared and presented by CH2MHill in July 1999. The City did not adopt the CH2MHill Master Plan Study, presumably because of its high cost of implementation.

Other studies of relevance to this master plan include: *Sunrise Development – Community Structure Plan* (Stantec Consulting Inc., December 2001); *Sunrise Development – Water & Wastewater Treatment Plant Feasibility Study* (Stantec Consulting Inc., March 2002); *Water Management & Conservation Plan* (Franson-Noble & Associates, Inc., March 1999); *Well Inventory Study* (Franson-Noble & Associates, Inc., August 1999); *Water Conservation Credit Program Feasibility Study* (prepared by Franson-Noble & Associates, Inc., June 1999); *Water Supply Study* (Franson-Noble & Associates, Inc., February 1999); *Reconnaissance Study of Irrigation Systems in South Jordan City* (Franson-Noble & Associates, Inc., December 1997).

CHAPTER 2
EXISTING SECONDARY WATER SYSTEMS AND SOURCES

The following chapter describes the existing secondary water systems and also the problems and needs involved in implementing a secondary system within South Jordan City. Additionally, this chapter describes the sources of water that are available for use in a secondary water system.

2.1 Existing Secondary Systems

As mentioned previously, about one-third of the residents of South Jordan City have access to secondary water piping through many independent systems scattered throughout the City. However, the systems are not interconnected, the majority of them cannot be pressurized for sprinkler use and many of the systems are not presently connected to a water source and are not operable. These systems and their locations are shown in Figure 2-1.

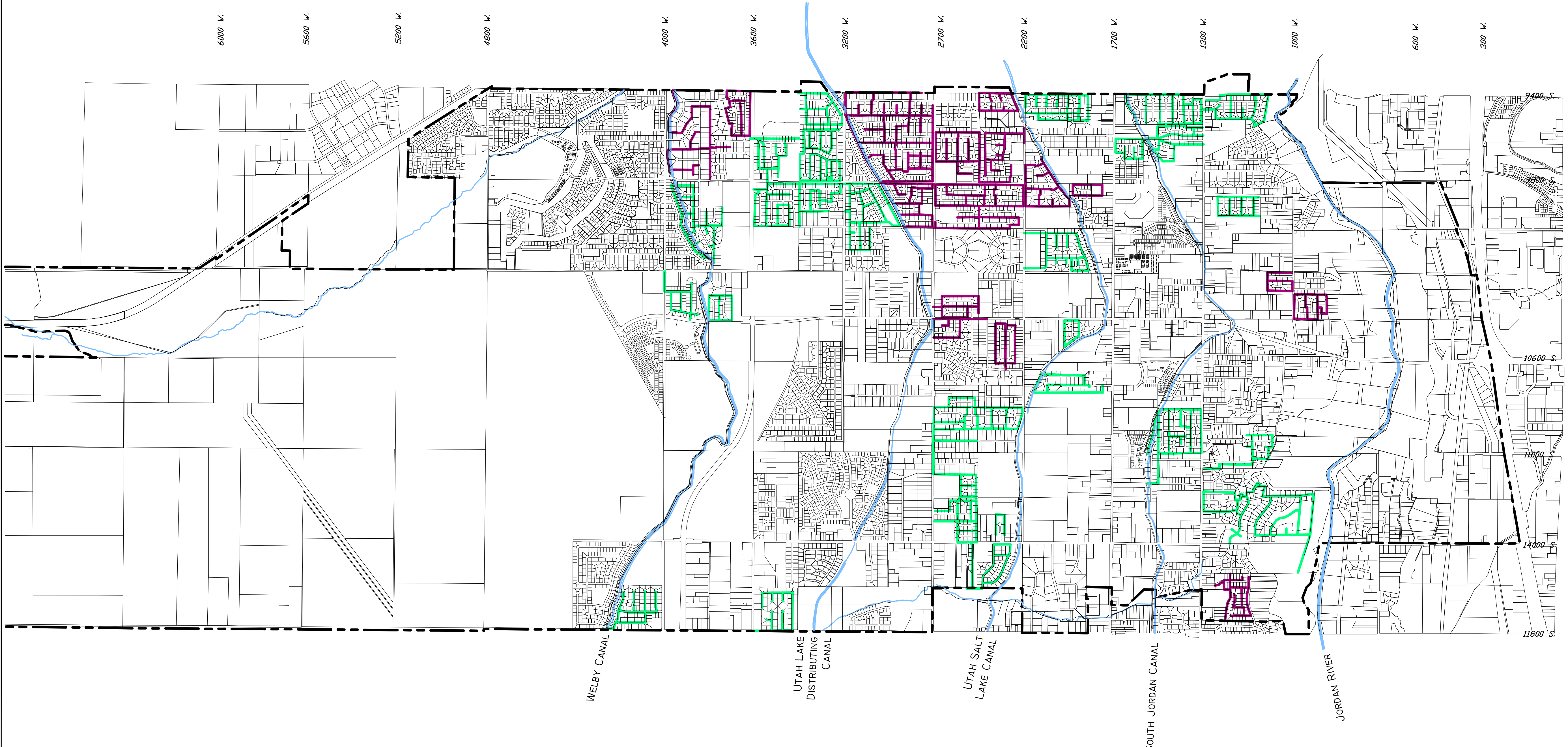
Through discussions with City Staff, it was apparent that only a small number of these secondary systems are operating satisfactorily with the majority of the systems having significant problems. These problems are identified and discussed in the following paragraphs.

2.1.1 Distribution Systems

In the early 1980's, the City began to require developers to install secondary water piping to provide landscape irrigation water. The resulting systems, generally fed directly out of the irrigation canals, were all designed as independent systems and a uniform design standard was not followed until recently. Many of these independent systems use low-pressure plastic irrigation pipe (PIP) and are not pressurized. There is also a wide range of pipe diameters that have been used in these systems. Along the various canals, there are a number of existing turnouts for the existing secondary water and agricultural irrigation systems. In conversations with City Staff the majority of the systems are in reasonable working order.

About 182,000 feet of existing pipe is available that can be utilized in a city-wide pressurized system. This pipe is either Class 200 or C-900 PVC pipe. Although there is about 128,000 feet of existing PIP pipe currently used for secondary water within the city, its low pressure rating does not make it suitable for use in a pressurized system.

Within the City of South Jordan there are also private secondary water systems that deliver irrigation water to individual residents. These systems were not independently identified within this report due to the City not having records of the private systems. The City may be able to utilize the existing ditches and pipe alignments for a city-wide pressurized system. Some of these systems may have surplus water shares that could be made available to the City.



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Legend

Plastic Irrigation Pipe

C900 or Class 200 PVC Pipe

Note:
Not all Piping Connected
to Water Source

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ENGINEERING

South Jordan City
Secondary Water System

PROJECT LEADER: Richard M. Noble
DRAFTSMAN: LMF
DATE: July 15, 2004

Existing Pipes.dwg
H:\Client\3-Salt Lake Area\So. Jordan City\Water Mgmt. & Cons. Plan\2004 Water Cons. Plan
Layout: Fig. 2-1 (Secondary Water)

Figure 2-1
Existing Secondary Systems

2.1.2 Operation & Maintenance

An additional problem with the existing secondary systems is the location of pipelines. Many of the existing pipelines are located in the residents' backyards. These pipelines are difficult to access and are therefore not ideally situated for maintenance.

As a water conservation practice, the Utah Division of Water Resources has recommended restricting daytime watering. The City tried to institute a water conservation policy that recommends residents not water lawns between the hours of 10 A.M. and 6 P.M. However, this mode of operation caused operational problems with the canals, which cannot facilitate this variable demand. Therefore, the City has currently withdrawn this policy but still recommends even/odd day watering between 6 pm – 10 am for culinary users.

2.1.3 Storage

The daytime watering restrictions necessitate a need for sufficient storage to handle the demands during the shorter watering period. Currently none of the existing secondary systems have a storage reservoir and the systems are essentially relying on the canals for their entire storage. This operating condition poses considerable problems for the canal companies. This mode of operation will not be able to continue in the future, particularly as water use within the city increases.

2.1.4 Water Quality

A significant problem with the existing secondary systems is that the source water, originating from Utah Lake, is of generally poor quality. This water has been shown to have a high percentage of total dissolved solids (TDS), including a high concentration of sodium, which can have a harmful effect on ornamental plants such as flowers and shrubbery. The source water also has a pungent odor attributed to the growth of algae during certain times of the year. In addition the Utah Lake water also has a high percentage of total suspended solids (TSS), which includes the transport of seeds and other matter that tends to clog sprinkler heads.

Another concern is the pollutants introduced into the canal systems from storm drains. The EPA has recently enacted the National Pollutant Discharge Elimination System (NPDES) phase II program. The phase II program targets the elimination of pollutants from entering the canal systems. Many canal companies have also started a moratorium against receiving new storm drain connections.

2.2 Water Sources

2.2.1 Irrigation Company Shares

The City owns water shares, within the various canals that cross the city, sufficient to serve its present needs. South Jordan has an existing ordinance that requires developers to convey water shares to the City before approval of a subdivision is granted. This ordinance has increased the City's canal water shares over the past few years.

Table 2-1 summarizes the City's existing water shares within each canal company and the yearly water volume that would be available from each canal. As shown in the Table, the total water shares as of September 10, 2004 are estimated to yield an annual supply of 11,925 acre-feet per year. Only those canals on the west side of the Jordan River can be readily used as sources for a secondary water system. The City's water rights in these four canals provide a supply of 9,077 acre-feet per year. The canals on the east of the Jordan River pose problems in their location and would require additional pumping in order to service the City as a water source for a secondary system.

Table 2-1
Existing South Jordan City Water Shares, as of September 10, 2004

Canal Company	No. of Shares	Yield (acre-feet)	Total Supply (acre-feet)	Percent Conveyance Loss	Available Supply (acre-feet)
South Jordan Canal Company	543.5	4.94	2,685	5.0%	2,551
Utah Lake Distributing Company	535	5.11	2,734	20.0%	2,187
Utah & Salt Canal Company	622	4.59	2,855	10.0%	2,570
Welby Jacob Water Users Company	2,171	1.00	2,171	18.5%	1,769
Sub total:	**3,871.5**		**10,445**		**9,077**
Beckstead Irrigation Company	169	4.09	691	17%*	574
Brighton & North Point Irrigation Company	750	2.86	2,145	17%*	1,780
North Jordan Irrigation Company	346	1.72	595	17%*	494
Sub total:	**1,265**		**3,431**		**2,848**
Grand Total:	**5,136.5**		**13,876**		**11,925**

* Losses assessed by irrigation company not known. Used Utah Division of Water Resources reported average of 17 percent

When utilizing the canal water as a source for the secondary irrigation system, the reliability of the conveyance systems and the water supply is of concern. On August 11, 2003, the Utah Lake Distributing Canal was taken out of service for the remainder of the irrigation season due to a landslide below the canal. This outage created a significant hardship for South Jordan residents who rely on that canal system.

Additionally, the irrigation shares owned by the City are based on water rights in Utah Lake. About 71 percent of these are primary water rights and are very secure. The remaining 29 percent are secondary rights and are subject to curtailment in drought conditions. In most years the secondary rights will be a reliable source of water. However, in extreme drought years, when the level of Utah Lake drops below 285,000 acre-feet of total content, secondary water rights can be cut off. Before this happens, any Utah Lake water that is held in upstream reservoirs (such as Deer Creek and Jordanelle) must be released to Utah Lake. This infrequent curtailment generally occurs late in the irrigation season (September or October). In that event, the City would have a reduced water supply for its secondary system for the remainder of the irrigation season. Primary water rights would not be curtailed until Utah Lake drops below 160,000 acre-feet of content. Since 1932, the contents of Utah Lake have dropped below 285,000 acre-feet in 17 out of 70 years. The last time was in 1992. Prior to that, the lake level had not dropped that low since 1963. Projections for the future are that the lake will generally not be drawn down as low as it has historically. This is because of declining irrigated agriculture in Salt Lake County and because Utah Lake water stored in upstream reservoirs will help firm up the water supply.

2.2.2 Groundwater

The City of South Jordan does not have a significant amount of groundwater rights. There are other existing water rights within the City that may be transferred or purchased if the need should arise to utilize groundwater sources. However, the State Engineer has developed a groundwater management plan for the Salt Lake Valley. This plan places limitations on the transfer of groundwater within the valley. Additionally, because of the contamination of groundwater in the area, the State Engineer has indicated that applications which propose to change the point of diversion or drill a replacement well will be critically reviewed so as not to interfere with the proposed remediation process. South Jordan City is located in this area of contaminated groundwater.

2.2.3 Recycled Wastewater

Due to the recent drought conditions along the Wasatch Front, a great deal of interest has been focused at water reuse. The intent is to utilize reclaimed water from sewer treatment plants within secondary irrigation systems. Currently, South Valley Sewer District conveys sewer flows, in South Jordan, to the South Valley Water Reclamation Facility. This reclamation facility does not reuse its water. Therefore, reuse water is not available to the City at present. In the future if reuse water becomes a viable option the City should consider the alternative. Currently there are legal water right issues related to the utilization of reuse water that would need to be resolved. The reuse water quality could offer improved quality compared to the existing canal water and allow the City to conserve water supplies for culinary purposes. However, without a secondary system, recycled wastewater would not be possible.

2.2.4 Jordan Valley Water Conservancy District Water

Jordan Valley Water Conservancy District as a wholesale water supplier could assist with providing water to the City. However, the water received from the District is treated and expensive. This alternative though viable contradicts the City's attempt to utilize non-drinking water sources to conserve drinking water.

CHAPTER 3
POPULATION, GROWTH AND WATER DEMAND PROJECTIONS

3.1 Population Projections and Future Growth Areas

A key factor in the design of a city-wide system will be the consideration of future growth. As South Jordan City continues to grow, both in terms of population and in amount of developed area, the delivery of irrigation water at an acceptable quantity and pressure will be of paramount importance. The following section discusses population projections and future growth areas as they affect the proposed South Jordan City-Wide Secondary System.

3.1.1 Population Projections

The City has recently projected a build-out population of 99,000 within the next 30 years, which includes the Daybreak Development. Currently, the City has a population of over 38,000, which includes 10,856 individual residences and will provide approximately 17,138 residences at build-out. Future growth will occur in undeveloped areas lying within the current city limits. The build-out limits are assumed to be the same as the total build-out limits for the purposes of this study only and are not intended to reflect the actual policies of South Jordan City.

3.1.2 Future Zoning

The City provided a Future Land Use Map dated June 2004, see Figure 3-1, which was utilized to determine the future build-out zoning conditions. The map does not always reflect current zoning but instead the City's intentions for use at City build-out. The future land use map is a dynamic document utilized for planning purposes.

Based on the population projections, by the year 2030 the City will be considered to be in a full build-out condition with no vacant land remaining for future development. Areas previously designated as agricultural lands are now changing to residential, commercial, and industrial particularly in the western half of the City. Proposed developments include a number of commercial parks along the Bangerter Highway, Redwood Road, Jordan Parkway, and areas immediately adjacent to the Jordan River floodplain. Additionally, industrial parks are proposed north of 10200 South, west of 4800 West, and immediately adjacent to the Jordan River floodplain in the northeastern part of the City. The remainder of the City's future development will be predominately residential with low to medium density designations.

3.1.3 Daybreak Development

Kennecott Land Company (KLC) is in the process of developing 4,127 contiguous acres of land over the next 20 years. This development is known as the Daybreak project and is located on the furthest west side of the City. The mixed-use community of residential, retail, industrial, and

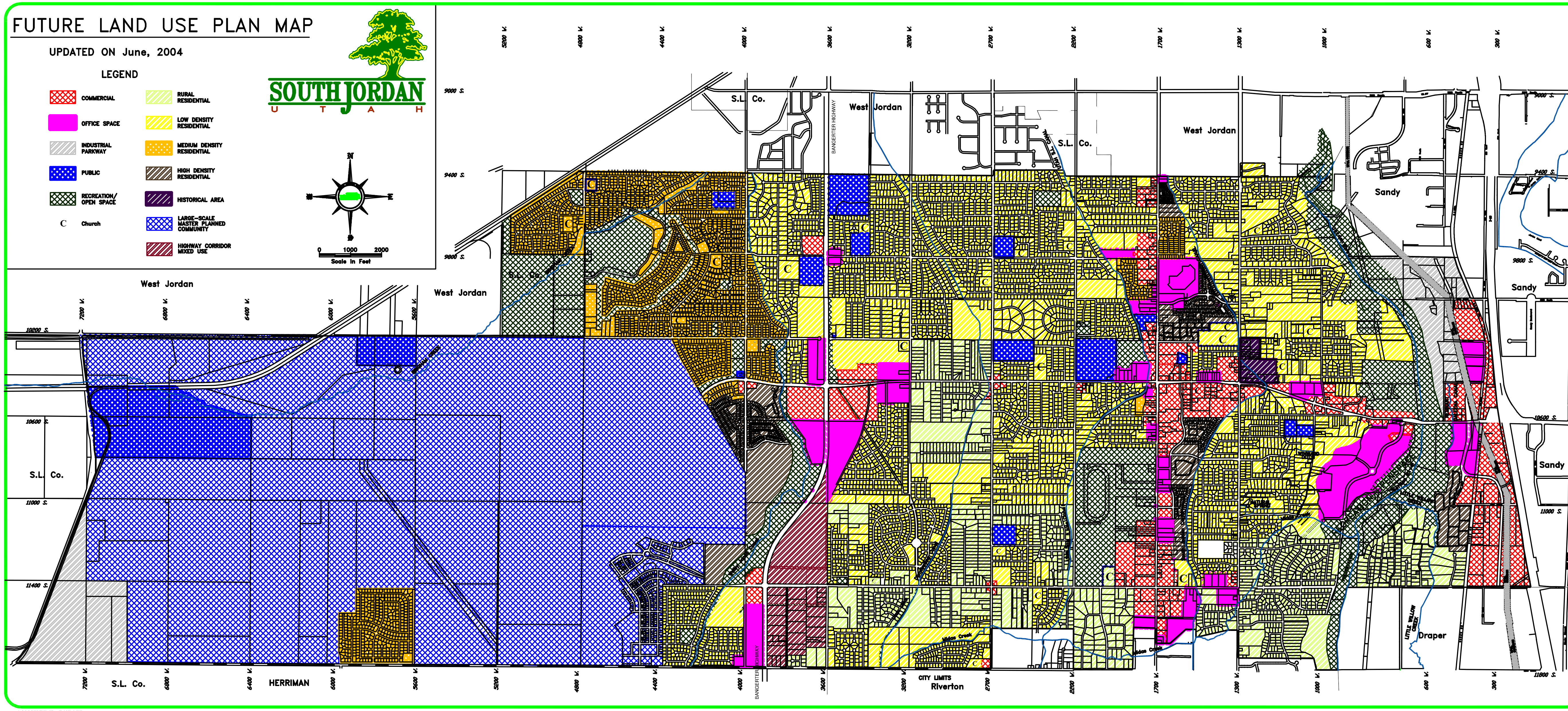

Figure 3-1

Future Land Use Plan Map

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LAYOUT: Layout: Layout2

South Jordan City

Secondary Water System

Master Plan

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office developments has been designed to be self-sustained. Approximately 25 percent of the 4,127 acres will be open space and parks.

This community has been master planned to emulate South Jordan's water and sanitary sewer operations (see Stantec - Water & Wastewater Treatment Plan Feasibility Study). Daybreak is currently constructing a secondary water system which will serve the major irrigation water users only (i.e. common areas, open space, lake supply, etc.). For the purposes of this master plan, the Daybreak Development was not included in the study.

3.1.4 Sunstone Development

The Sunstone Development is located on the far southwest side of the city. The development is not contiguous with any parts of the city that will be serviced by the City-developed secondary system. Therefore, the Citizens Study Committee determined that it was not practical to deliver secondary water to the Sunstone Development.

3.2 Outdoor Water Demands

Because the secondary water system will be used for outdoor irrigation, system water demands are based on the amount of irrigated area. A percentage of irrigated area was developed for each land use type as shown on Figure 3-1.

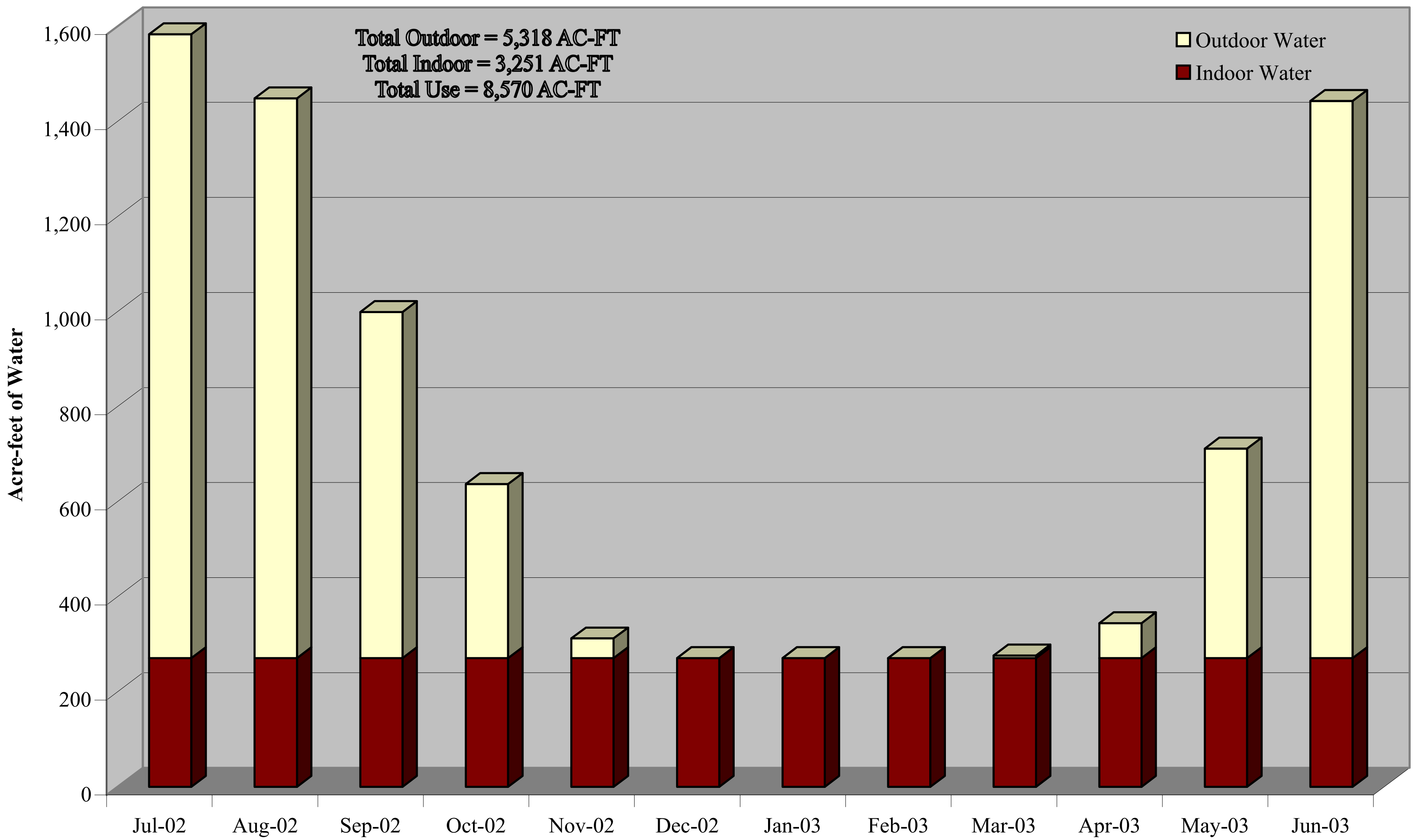
3.2.1 Historical Water Use

Figure 3-2 shows South Jordan City culinary water use by month for the year 2002- 2003. As anticipated, the figure depicts water use drastically increasing during the warmer summer months and then decreasing with the cooler winter months. An important feature also illustrated in Figure 3-2 is the quantification of outdoor water use versus indoor water use. Indoor water use can be assumed to remain nearly constant year round, while outdoor water use begins in March, peaks in July, and ends in October. The total indoor and outdoor water use can be quantified by determining a hypothetical line of segregation. The use of dark and light shades in Figure 3-3 creates a line of segregation, which defines the two separate uses. Total culinary outdoor use for the year 2002-2003 was quantified as approximately 5,318 acre-feet while total indoor use was quantified as approximately 3,251 acre-feet, resulting in a total water use of approximately 8,570 acre-feet.

3.2.2 Irrigated Area Density for Each Land-Use Zone

Each parcel of land within South Jordan City has been zoned for a specific use. General categories of these uses include residential, commercial, office and industrial. Several variations of each category exist. For example, the residential land use category is broken into subsets that identify the number of dwelling units per unit of area. One such subset is low density residential, which represents a residential zone having 1.8 lots per acre. The official future land use map prepared by the City, defines these land use categories and their subsets.

Figure 3-2
South Jordan Culinary Water Use



An average irrigated density for each land use zone was determined in a previous secondary water system study (see CH2MHill – Secondary Water System Master Plan, July 1999, p. 2-2). These values have been checked for accuracy and will also be used in this study with a few minor adjustments. The density zones and their percent of irrigated areas are shown in Figure 3-1. Based on information shown in the figure, the total irrigated area under build-out conditions (excluding Daybreak and Sunstone Developments) is 3,846 acres.

3.2.3 Irrigation Requirements

Irrigation requirements are based on the consumptive use of the vegetation being irrigated. The primary vegetation that the proposed secondary system will irrigate is turf. The annual consumptive use requirement for turf in South Jordan was also determined in the previous secondary water system study (see CH2MHill – Secondary Water System Master Plan, July 1999, p. 2-3). Using an application efficiency of 65% and a conveyance efficiency of 90% the requirement was determined to be 36 inches or 3-acre-feet/acre.

The total annual water demand for South Jordan at build-out was then determined by multiplying the 36-inch consumptive use requirement by the total irrigated area previously determined. The total annual water demand was calculated as 11,538 acre-feet at build-out conditions. As was shown earlier, the culinary outdoor water use for the City in 2002-2003 was 5,318 acre-feet, resulting in a difference of 6,220 acre-feet. This difference can be accounted for in the amount of secondary water currently used and the proportion of land currently utilizing secondary irrigation systems versus a much larger area that will need to be irrigated at total build-out.

Peak instantaneous demand values are based upon Utah State Division of Drinking Water Requirements of 7.92 gallons per minute per irrigable acre. For the purposes of this Study the peak instantaneous demand has been increased by 1.5 times to 11.88 gallons per minute to reflect future daytime watering restrictions within the City. Because the peak instantaneous demand values reflect the largest volume of water that will need to be delivered at any one time, they will be used to size the proposed system pipelines.

3.3 Future Culinary Water System Needs

As was discussed in Chapter 1, one of the major motives behind the implementation of a secondary system is the cost savings incurred from not having to use high quality water for irrigation purposes. These cost savings are magnified as the City grows and continually adds new culinary water connections.

An additional problem attributed to the growing population is the declining amount of culinary water for future growth and the necessary culinary distribution and storage improvements associated with a growing City. Not having to use the high quality culinary water for irrigation purposes will free up culinary water and reduce the required improvements to the culinary system.

CHAPTER 4
SECONDARY WATER SYSTEM MASTER PLAN

South Jordan City's plan for its secondary water system is to implement a city-wide pressurized irrigation system excluding the Daybreak and Sunstone Developments. This Chapter describes the system design criteria, the proposed secondary water system and estimated system costs.

4.1 System Design Criteria

To ensure the secondary system will operate effectively and efficiently, design criteria were established. Franson Noble Engineering developed a computerized hydraulic model to evaluate the hydraulic capacity of existing secondary water pipes and size and plan the location of proposed improvements that are needed to connect the existing independent systems and provide secondary water service to other areas of the city. The model evaluates pipes, pump stations, storage reservoirs, and water demands by incorporating the design and operating criteria developed by Franson Noble, City staff and the Citizens Study Committee. Specific output for the models may be found in Appendix A. The following section describes the criteria and method of analysis used in sizing the selected system.

4.1.1 Pressure Criteria

The proposed plan requires pressure zone boundaries, which are based upon the criterion that dynamic pressures fall generally within the range of 50-100 psi. Additionally, the pressure range in a secondary system should be lower than the culinary system. Maintaining lower pressures in the secondary system reduces the possibility of secondary water entering and contaminating the culinary system if the two systems accidentally become connected. Currently, there are five proposed pressure zones.

The proper sizing of the distribution pipelines is essential to ensure efficient and cost-effective water delivery. Determination of water line diameters is based on the following criteria:

- 50-100 psi pressure range to ensure sufficient pressure for sprinkler operation.
- Pressure reducing valves to prevent line damage with excessive pressures.
- A maximum velocity of 5 feet per second in lines less than 24-inches and 7 feet per second in lines 24-inches or greater to ensure minimal friction losses and prevent line damage.
- A minimum pipe size of 8 inches for new pipes.
- A minimum pipe size of 6 inches for existing pipes.
- C-900 PVC pipe and C-905 PVC pipe to be used with an accompanying Hazen Williams friction loss coefficient of 130-140, depending on pipe size.
- Steel pipe for pipe sizes greater than 24-inches.
- Pipe to have a minimum cover of 2 feet.

4.1.2 Velocity Criteria

The useful life of a water pipeline can be decreased by scour from high water velocities. Good engineering practice sets pipeline maximum design velocities at or near 5 feet per second. The proposed pipelines were designed using a maximum velocity of 5 feet per second in lines less than 24-inches and 7 feet per second in lines 24-inches or greater. These criteria ensure minimal friction losses and prevent line damage. Many of the existing secondary pipes are much larger than needed for these criteria.

4.1.3 Demand Criteria

An application efficiency of 65 percent was used to represent the losses from the sprinkler to the plant root. The efficiency accounts for evaporation, misting and sprinkler adjustment onto driveways or walkways, and percolation into groundwater. An annual requirement of 36 inches of water was utilized in determining demands with a peak demand of 11.88 gpm/acre. Also included with the peak demand water requirements was the City's recommendation of limiting daytime watering from 10 AM to 6 PM. The watering limitation increased the peak demand of the system.

4.1.4 Storage Capacity Criteria

Storage Capacity is based upon an operating scenario where water is delivered from the irrigation canals at a steady rate around the clock while restricting water delivery through the system to the hours of 6 PM to 10 AM. Providing this storage will avoid operational problems in the canals caused by a fluctuating demand.

4.1.5 System Analysis

Haestad Method's WaterCAD Version 6.0, which is computer pipe network analysis software, was chosen to model the system's hydraulics. Specific output from the project model may be found in Appendix A.

4.2 Secondary System Description

4.2.1 General

The proposed system will provide a city-wide pressurized irrigation system excluding the Daybreak and Sunstone Developments. The system will provide sufficient pressures to allow for proper sprinkler operation. This system will utilize the 34.5 miles of existing pressurized pipe but would abandon the low pressure pipe. Storage facilities will be built to supply adequate volumes during peak demand periods and would facilitate the City's daytime watering restrictions without imposing undue operational difficulties for the canals. Other facilities required for implementation of the project include installing pressurized transmission lines, pump stations, and filters. The system will supply a total of 11,538 acre-feet of water to irrigate 3,846 irrigated acres.

The proposed system is shown in Figure 4-1, including proposed pipelines and the facility locations. The pump stations will require a total of 2,395 kilowatts of power and an annual energy demand of approximately 5.2 million kilowatt-hours. As shown, the system will require five storage ponds to supply adequate volumes during peak demand periods without drawing solely from the canals.

As previously stated, the system is designed for minimum pressures of 50 psi depending on where the homes are in relation to the pressure zone. Pressures up to 100 psi may be available at the top of the pressure zones. This size service is capable of giving up to 50 gallons per minute and will adequately meet the resident's outdoor watering needs.

4.2.2 Water Sources

The proposed system will supply a total of 11,538 acre-feet of water. The source of water used for this study is solely based upon the utilization of Utah Lake water conveyed through the existing canals. Table 4-1 shows the required source capacity available in each canal. Other potential sources are described in Chapter 2. These sources could be added to the system at a later date if the opportunity arises. Another potential water source would be to use recycled wastewater.

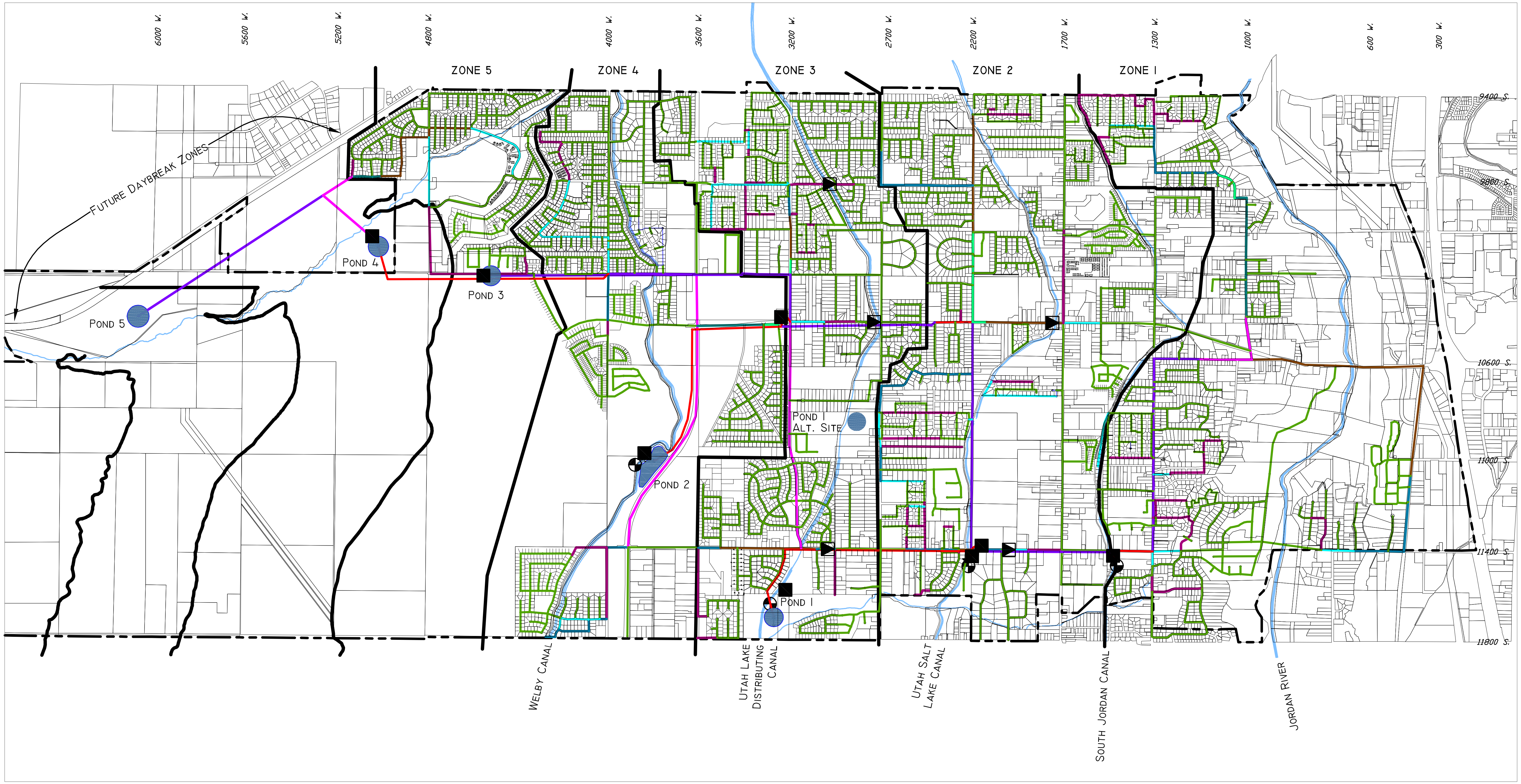
Table 4-1
Required Water Source Capacity

Source	Capacity (gpm)
Welby Canal	5,993
Utah Lake Distributing Canal	9,289
Utah and Salt Lake Canal	7,791
South Jordan Canal	6,892
Total	29,966

4.2.3 Transmission and Distribution Pipelines

The sizing of the secondary system was accomplished using WaterCAD in accordance to criteria previously described. The proposed system consists of pipelines ranging in diameter from 8-inches to 36-inches, and will utilize some existing 6-inch pipe. The total length of existing pipe is 34.5 miles, with an additional 125 miles to be installed. The sizes of these new pipes are shown in Figure 4-1. It was assumed in the hydraulic analysis and cost estimate that C-900 and C-905 PVC pipe would be installed for pipes that are 24 inches in diameter and smaller. Steel pipe would be used for pipes larger than 24 inches. These distribution lines are needed to connect the existing pressurized systems and to supply the remaining city areas without a current system.

All proposed system pipelines have been designed to deliver the total build-out demand throughout the city excluding the Daybreak and Sunstone Developments. Therefore, the pipelines would not need to be replaced by larger pipelines as the City continues to develop.



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6 INCH PIPE		20 INCH PIPE	
8 INCH PIPE		24 INCH PIPE	
10 INCH PIPE		30 INCH PIPE	
12 INCH PIPE		36 INCH PIPE	
14 INCH PIPE		FILTER LOCATION	
16 INCH PIPE		PUMP STATION	
18 INCH PIPE		PRESSURE RELIEF VALVE	

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SOUTH JORDAN CITY
SECONDARY WATER SYSTEM
MASTER PLAN

PROJECT LEADER: RICHARD M. NOBLE
DRAFTSMAN: LMF
DATE: SEPT. 21, 2004
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Layout: Alt. A

FIGURE 4-1
PROPOSED SECONDARY WATER SYSTEM

4.2.4 Storage and Regulating Reservoirs

The proposed secondary system will require five storage reservoirs with a total of 88.3 acre-feet of storage. The storage sites were chosen to provide adequate elevation head to create the minimum operating pressures for the system, as well as within relatively flat open areas to reduce the amount of earthwork. They were sized to provide a steady delivery of water from the canals while allowing daytime watering restrictions. The storage facilities range from 4.2 acre-feet to 25.9 acre-feet of required storage volume. The reservoirs will be lined with reinforced concrete to minimize seepage losses and to facilitate removal of accumulated sediment and debris. Design data for the ponds is summarized in Table 4-2.

Table 4-2
Storage Pond Design Data

Pond	Location	Storage Capacity (acre-feet)	Maximum Water Surface Elevation (feet)
Pond 1	East of Utah Lake Distributing Canal	21.4	4550
Pond 2	East of Welby Canal	25.9	4670
Pond 3	East of 4800 West	24.2	4800
Pond 4	East of 5200 West	12.6	4860
Pond 5	West of 6000 West	4.2	4955

4.2.5 Booster Pump Station Locations

The booster pump station locations, shown on Figure 4-1, were selected to minimize piping and allow for adequate pressures. The majority of the pump stations are intended to lift water to reservoirs above the canals. Two pump stations were added to the system below the Utah Lake Distributing Canal and Welby Canal to provide pressure so that the water can be filtered prior to being discharged into the ponds.

4.2.6 Filter Stations

As a minimum requirement, all water will pass through a 300-micron filtration process. This filter size will remove sand, seeds, moss and other nuisances found within the existing canal system. Four filter stations were located within the secondary system and filters were placed so that water from the canals was filtered only once. All water would be filtered before being stored in reservoirs. It was assumed that water discharged from reservoirs would not need filtering but only screening for large materials. The proposed filters require a minimum operating pressure of 35 psi and cause a 7 psi pressure loss across the units.

4.2.7 Pressure Reducing Valves (PRVs)

In order to maintain pressures within the defined criteria and avoid any damage to the distribution system, pressure reducing valves (PRVs) will be placed at specific locations (see Figure 4-1). PRVs located within the same pressure zone will be set at the same hydraulic grade as well as set to allow the maximum possible pressure without exceeding the defined maximum of 100 psi.

4.2.8 Connections and Meters

The outdoor water flow from a secondary water system is different than water flow from a culinary water system in a number of ways. The standard size for typical secondary water systems is ¾-inch or 1-inch service. The additional amount of water that a 1.25-inch connection carries will provide adequate water for the resident's outdoor watering needs for up to one acre of property.

Individual connections to the system for homeowners will be 1.25-inch in diameter and dual connections will be 2-inches in diameter. Dual connections allow two adjoining lot owners to share one connection from the main pipe, which saves installation costs. It is assumed that construction of the residential connections will utilize directional drilling to offer minimal asphalt reconstruction. Commercial and institutional connections will need to be sized sufficiently to convey peak water demands for the properties.

Last fall the City installed a Metron meter as a test to measure water flow from a commercial connection. Until recently there has not been a meter durable enough to measure secondary water. Conventional meters' working parts are damaged when, during the winter, mineral deposits harden within the meter. Therefore, the City has installed this test meter to determine if the Metron meter is a viable option for measuring secondary water. The meter will be examined after a full year to analyze how it performed.

4.2.9 Required Ordinances and Policies

To ensure a successful secondary system, the city will need to create certain new ordinances and policies. These policies will direct developers to install secondary water lines in new developments. The developers must also provide only useful water shares to the City (i.e. only primary water shares that are available in the South Jordan Canal, the Utah Salt Lake Canal, the Utah Lake Distributing Canal, and the Welby Jacob Canal). The policies will also direct the mandatory use of the secondary water by residents and the adoption and enforcement of restricting daytime watering from 10 AM to 6 PM. A stringent cross connection control program and policy will also have to be developed and maintained to ensure that the secondary system does not contaminate the culinary system.

4.2.10 Cost Estimates

An important aspect of a master plan is the cost of constructing and operating the proposed facilities. Costs were prepared from information available at the time of the estimate. A great deal of care was taken while preparing the costs for accuracy. Final costs incurred by the City will depend on actual labor and material costs, market conditions, site conditions, scope of work and other fluctuating factors. Due to these varying factors, it is recommended that, specific project budgets should be examined individually.

4.2.10.1 Construction Cost Estimates

Table 4-3 summarizes the total construction costs for the secondary system improvements. Costs were developed using information from the City, local material suppliers and similar project

Table 4-3
Secondary System Capital Cost Estimate

Item	Item	Quantity	Unit	Unit Price	Amount
1	Mobilization (5%)	1	LS	$ 2,067,000.00	$ 2,067,000
2	Diversion of source water	4	EA	$ 25,000.00	$ 100,000
3	Telemetry System	1	LS	$ 150,000.00	$ 150,000
4	Flow Measurement	4	EA	$ 10,000.00	$ 40,000
5	8 Pump Stations	3054	HP	$ 625.00	$ 1,908,750
6	Filtering Systems at 300 Microns	4	EA	$ 150,000.00	$ 600,000
7	5 Storage Reservoirs	88.3	AC-FT	$ 23,500	$ 2,075,050
10	Furnish & install 8" PVC Pipe w/ Pavement Repair	473,021	LF	$ 24.23	$ 11,461,299
11	Furnish & install 10" PVC Pipe w/ Pavement Repair	27,998	LF	$ 27.87	$ 780,304
12	Furnish & install 12" PVC Pipe w/ Pavement Repair	15,093	LF	$ 39.19	$ 591,495
13	Furnish & install 14" PVC Pipe w/ Pavement Repair	20,128	LF	$ 42.45	$ 854,434
14	Furnish & install 16" PVC Pipe w/ Pavement Repair	22,311	LF	$ 48.75	$ 1,087,661
15	Furnish & install 18" PVC Pipe w/ Pavement Repair	4,843	LF	$ 57.50	$ 278,473
16	Furnish & install 20" PVC Pipe w/ Pavement Repair	6,605	LF	$ 62.00	$ 409,510
17	Furnish & install 24" PVC Pipe w/ Pavement Repair	21,670	LF	$ 70.00	$ 1,516,900
18	Furnish & install 30" Steel Pipe w/ Pavement Repair	40,109	LF	$ 139.40	$ 5,591,195
19	Furnish & install 36" Steel Pipe w/ Pavement Repair	26,672	LF	$ 158.75	$ 4,234,180
20	Furnish & install valves & fittings	1	LS	$ 3,994,000	$ 3,994,000
21	Bangerter Highway Crossing	320	LF	$ 525.00	$ 168,000
22	1.25" Single Sevice Connections	3,426	EA	$ 1,000.00	$ 3,426,000
23	2" Double Sevice Connections	1,713	EA	$ 1,200.00	$ 2,055,600
24	6-inch Pressure Reducing Valves & Fittings	2	EA	$ 27,000.00	$ 54,000
25	8-inch Pressure Reducing Valve & Fittings	1	EA	$ 28,000.00	$ 28,000
26	10-inch Pressure Reducing Valve & Fittings	1	EA	$ 29,000.00	$ 29,000
27	14-inch Pressure Reducing Valve & Fittings	1	EA	$ 37,000.00	$ 37,000

Subtotal		$ 43,537,800
~10% Contingency		$ 4,400,000
Total Construction Cost		$ 47,900,000
Land Acquisition		
Pond 1	2.1 acres	$ 472,500
Pond 2	2.6 acres	$ 260,000
Pond 3	2.4 acres	$ 240,000
Pond 4	1.3 acres	$ 130,000
Pond 5	0.4 acres	$ 40,000
Pump Stations	2 acres	$ 200,000
Total Land Acquisition		$ 1,350,500
~15% Design & Construction Engineering		$ 7,200,000
~1% Administration, Legal, Bond Counsel		$ 500,000
Total Engineering, Administraction and Land Cost		$ 9,050,500
Total project cost		***$ 56,950,500***

costs along the Wasatch Front. The total construction cost includes estimates of Capital Improvements, Contingency, Land Acquisition, Design and Construction Engineering, Administration, Legal and Bond Counsel. As shown in the table, the total construction cost is $56.95 million.

4.2.10.1.1 Contingency

It is common practice to apply a contingency factor in feasibility level cost estimates to cover unforeseen expenses. The contingency for this study was approximated at 10 percent.

4.2.10.1.2 Land Acquisition

Land acquisition costs were estimated to include additional land required by the City to place pump stations and storage facilities. For estimation purposes it was assumed that an undeveloped acre in South Jordan would cost $100,000. Undeveloped land with a recorded plat is assumed to be $225,000 per acre.

4.2.10.1.3 Design and Construction Engineering

Design engineering includes those costs associated with preparing design drawings, technical specifications and contract documents. Construction engineering includes the cost to ensure the system is built according to specifications and if necessary to make design changes during construction. These costs have been approximated to be 15 percent of the total construction costs.

4.2.10.1.4 Administration, Legal & Bond Counsel

These costs are primarily incurred in coordinating the project financing. This value was approximated at one percent of the total construction costs.

4.2.10.2 Annual Operation and Maintenance Cost Estimates

The annual Operation and Maintenance (O&M) costs for the secondary water system include operating the storage facilities, water lines, pump stations, and filters. The costs include equipment, labor, materials, and administration fees. Table 4-4 summarizes the estimated secondary system O&M costs that may be incurred by the City.

Table 4-4
Estimated Secondary System O&M Costs

Operation & Maintenance Item	Annual O&M Costs
Staff Wages & Benefits	$400,000
Department Equipment	$80,000
Pump Station Maintenance	$28,000
Storage Facility Maintenance	$13,000
Water Line Maintenance	$75,000
Pump Operation (Electricity)	$228,000
Total:	**$824,000**